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Prevalence and Associated Factors of Intestinal Helminth Infections in Benhur Carriage Horses in Bima City, West Nusa Tenggara, Indonesia

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Abstract. This study aimed to identify the species and prevalence of helminth infestations in Benhur horses in Bima City, as well as factors associated with parascasis. A cross-sectional study was conducted by collecting fecal samples from Benhur horses, which were examined using flotation and sedimentation techniques. Data on horse characteristics, owner profiles, and management practices were analyzed descriptively, while associations between helminth infection and related factors were assessed using Odds Ratios (OR). The results showed that 86.3% of Benhur horses were infected with gastrointestinal helminths, with *Parascaris equorum* accounting for 82.4% and *Strongyle* spp. for 3.9%. Factors most strongly associated with parascarosis were provision of fresh, unwilted feed (OR = 2.5), lack of anthelmintic administration (OR = 2.1), owner occupation (OR = 1.83), and horse sex (OR = 0.72). These findings highlight the importance of proper feed management and regular anthelmintic programs to prevent helminth infections in Benhur horses.

Keywords: horse, benhur, helminthiasis, Bima city

1. Introduction

In Bima City, Benhur is a traditional two-wheeled horse-drawn carriage used for passenger transport and is still commonly seen. In other regions of Indonesia, similar carriages are known as delman, bendi, dokar, or kereta kuda. On Lombok Island, they are referred to as Cidomo. Benhur remains an important aspect of local life in Bima, particularly as a source of livelihood for the drivers and as a symbol of Benhur along streets and around traditional marketplaces.local culture.

This is evident from the frequent occurrence of gastrointestinal helminth infections in working horses, which can negatively affect their physical condition, resulting in a dull hair coat, poor body condition, weight loss, and a reduced Body Condition Score (BCS) [35]. Infected horses may also exhibit clinical signs such as tail or perineal pruritus, alopecia, skin irritation, stress, reduced energy efficiency, and, in severe cases, colic (Erianto & Khumaeroh, 2022; Syafindri et al., 2022; Rosyidi et al., 2025). The occurrence of these infections is influenced by several risk factors, including management practices, horse population density, stable hygiene, feed quality, sanitation, geographical location, age, water sources, and the frequency of anthelmintic treatment (Buana et al., 2023; Putranty et al., 2019). Therefore, improving stable hygiene, sanitation, and overall management practices is

essential to reducing the prevalence of gastrointestinal helminth infections while enhancing the health, welfare, and productivity of working horses (Pratama et al., 2023).

This is evident from the frequent presence of Gastrointestinal Helmiths infection in working horses can lead to a decline in physical condition, including dull coat, thin body, and low Body Condition Score [8]. Clinical signs may include tail or perineal itching, alopecia, skin irritation, stress, energy inefficiency, and potential colic (Erianto & Khumaeroh 2022; Syafindri et al 2022; Rosyidi et al 2025). The main risk factors for infection include management practices, horse density, stable conditions, feed, sanitation, location, age, water sources, and the frequency of deworming (Buana et al 2023; Putranty et al 2019). These findings indicate that improvements in hygiene and management practices are crucial for maintaining the health, welfare, and productivity of working horses (Pratama et al 2023).

Research on Benhur horses in Bima City remains very limited, particularly studies examining helminth infections. Most literature on traditional working horses in Indonesia focuses on dokar, delman, or cidomo, including a welfare assessment of horses in Bogor (Arifwal et al 2020), a study on *Trichostrongylus* spp. parasites in cidomo horses in Lombok (Buana et al 2020), and a welfare evaluation of dokar horses in Yogyakarta (Widi et al 2017). The absence of studies addressing helminth infection in Benhur horses in Bima, West Nusa Tenggara, underscores the need to investigate this issue as a basis for implementing effective prevention and treatment strategies.

To date, research on Benhur horses in Bima City remains very limited, particularly regarding helminth infections. Most literature on traditional horses in Indonesia focuses on dokar, delman, or cidomo, including studies on horse welfare in Bogor (Arifwal et al 2020), research on Trichostrongylus spp. parasites in cidomo horses in Lombok (Buana et al 2020), and assessments of dokar horse welfare in Yogyakarta (Widi et al 2017). The absence of studies addressing helminth infections in Benhur horses in Bima, West Nusa Tenggara.

The purpose of this study is to identify the types and prevalence rates, as well as factors related to helmiths infections in Benhur horses in Bima City. The results of this study can serve as a reference for the prevention and treatment of helminths infections in Benhur horses.

2. Research methods

a. Sample Collection

This study used a cross-sectional design and collected fecal samples from Benhur horses in Bima City. Samples were taken from three traditional markets where these horses are commonly found: Amahami Market, Lama Market, and Daya Indah Market. The sample size was determined using the formula $n = 1.96^2PQ/\alpha^2$ or $n = 4PQ/\alpha^2$, where n is the number of samples, P is the prevalence, Q is 1 – prevalence, and α is the margin of error (Prasad, 2020; Chirawatkul, 2017; Sudjai, 2020). With an assumed prevalence of 15% and a 10% margin of error, the sample size calculation produced $n = 4(0.15)(0.85) / 0.1^2 = 51$. Therefore, 51 fecal samples were collected. A total of 10 grams of horse feces were collected and placed into sample containers labeled with the owner's name, and the horse's sex and age. The fecal samples were then transported to the laboratory, stored in a refrigerator, and subsequently examined for the presence and types of parasite eggs using the flotation technique

b. Fecal Examination for Helminth Eggs

The natif test was conducted by mixing a small amount of feces with a little water, then placing the mixture onto a glass slide. A cover slip was carefully placed over the sample, and the preparation was examined under a microscope at 100x magnification. The centrifugation method is performed by placing 2 grams of feces into a mortar, adding a small amount of water, and mixing until fully homogenized. The mixture is then transferred into a tube until it reaches three-quarters of its volume and centrifuged for 5 minutes. This process produces a clear supernatant and a sediment. The supernatant above the sediment is discarded and replaced with saturated NaCl solution (Dryden et al 2015) until the tube is three-quarters full. The mixture is stirred thoroughly and centrifuged again for 5 minutes. After centrifugation, the tube is placed upright on a rack, and additional saturated NaCl solution is added until the liquid surface becomes convex. The tube is then left to stand for 3 minutes. To collect the parasite eggs,

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a glass slide is placed on the convex surface and carefully inverted. The slide is then covered with a coverslip and examined under a microscope at 100× magnification.

The sedimentation method uses a liquid with a lower specific gravity than that of helminth eggs, allowing the eggs to settle. The centrifugation method is carried out by placing 2 grams of feces into a mortar, adding a small amount of water, and mixing until homogenized (Kavanagh et al 2018; Traversa et al 2014). The mixture is then poured into a tube until three-quarters full and centrifuged for 5 minutes. This process yields a clear supernatant and a sediment. The supernatant above the sediment is discarded, and the sediment is collected, placed on a glass slide, covered with a coverslip, and examined under a microscope at 100× magnification

c. Observation of Horse Management Conditions To obtain information on the conditions of the horse owners, field observations and interviews were conducted. The data collected through the interviews included the owner's name, age, educational background, number of horses owned, the sex of the horses, daily net income from operating a *Benhur*, types of feed provided, type of employment (primary or secondary), source of drinking water, and the horses' deworming treatment.

d. Data analysis

Data related to the case of parasite egg infestation in Benhur's horse were analyzed descriptively, including prevalence rate and types of parasites. Similarly, observational data on the condition of Benhur's horse owner were analyzed descriptively. The association between factors and cases of *Parascaris* infestation was analyzed using the odds ratio (OR). The formula for the odds ratio is OR = (a/c) / (b/d) or (a × d) / (b × c), which represents the relationship between the four cells of a 2×2 contingency table (Robert et al 2019, Hoppe et al. 2017; Hu et al., 2020). A horse is classified as a positive case if parasite eggs are detected based on the characteristics of *P. equorum* eggs and as negative if no eggs are found. The odds ratio (OR) describes the relationship between an exposure and the occurrence of a disease. An OR = 1 indicates no association. An OR < 1 suggests that the exposure may have a protective effect. In contrast, an OR > 1 indicates that the exposure increases the risk of disease

3. Result and discussion

a. Equine husbandry practices and helminth egg examinations

A total of 51 Benhur horse owners were observed and interviewed, and 51 fecal samples were collected from three market locations where Benhur horses gather, as well as from outside the markets in Bima City. The fecal samples were then examined for the presence of helminth eggs. The results showed that 44 horses, or 86.3%, were infected with gastrointestinal helminths. The details of each helminth case and the observational results can be seen in Table 1.

The prevalence of gastrointestinal helminth infections in horses varies significantly across different regions. In Hawassa, Ethiopia, the overall prevalence among equids was reported at 78.5%, with donkeys exhibiting higher infection rates (92%) compared to horses (63.7%) (Mathewos et al 2021). Among Benhur horses in Bima City, Indonesia, the prevalence was even higher at 86.3%, indicating a substantial parasitic burden in this population. These findings highlight that gastrointestinal helminth infections represent a significant health concern in horses and underscore the need for effective control and management strategies (Mathewos et al 2021).

Several studies have reported varying prevalence and species distribution of gastrointestinal helminths in horses across different regions. In Payakumbuh City, West Sumatra, Indonesia, found an overall prevalence of *Parascaris equorum* of 14.06% among horses, with sub-regional variations ranging from 7.7% to 18.18% (Zelpina et al 2022). In Nakhon Si Thammarat, Thailand, Phetkarl et al (2024) reported a gastrointestinal parasite prevalence of 74.7% in horses, dominated by single infections of strongyles (50.6%) and co-infections of strongyles with *Gastrodiscus aegyptiacus* (10.1%) (Phetkarl et al 2024). Hamad et al (2024) also highlighted that although ivermectin treatment was initially effective, the egg reappearance period (ERP) reached six weeks with a mean fecal egg count reduction (FECR) of 70.4%, indicating a decline in anthelmintic efficacy (Hamad et al 2024).

In Hawassa District, Southern Ethiopia, reported a very high prevalence of gastrointestinal helminths at 78.5% among equids, with *Strongyle* spp. being the most common (56.1%) followed by *Strongyloides westeri* (35.5%) and *Parascaris equorum* (25.2%) (Mathewos et al 2021).

Table 1. Equine husbandry practices and gastrointestinal helminth egg examinations in Benhur horses in Bima City

No	Variable	Result
1.	*Parascaris equorum*	Positive : 42 (82,4%)
2.	*Strongyle spp*	Positive : 2 (3,9%)
3.	Owner's age	Average: 33.8 years (range 18–50 years)
4.	Owner's education	Uneducated: 5.9% Elementary school (SD): 66.7% Junior high school (SMP): 13.7% Senior high school (SMA): 13.7%
5.	Number of horses owned	Average: 2.43 (range 1–6 horses)
6.	Daily net income	Average: IDR 40,090 (IDR 30,000–50,000)
7.	Sources of income	Primary: 76.5% Secondary: 23.5%
8.	Horse age	Average: 5.3 years (range 2–10 years)
9.	Horse sex	Stallion : 94.1% Mare : 5.9%
10.	Type of forage	Grass : 100%
11.	Forage feeding method	Fresh : 94,1% Wilted : 5,9%
12.	Water source for horses	Well water: 0% Municipal water (PAM): 100%
13.	Administration of anthelmintics	Lack : 86,3%

In comparison, Benhur horses in Bima City, Indonesia, showed a markedly different pattern. The overall prevalence was 86.3%, with a notably high proportion of *Parascaris equorum* (82.4%) and a relatively low prevalence of *Strongyle* spp. (3.9%)This contrasts sharply with both Mathewos et al (2021) and Phetkarl et al (2024), where strongyles dominated the infection profile, while *Parascaris equorum* was generally less prevalent. The exceptionally high prevalence of *Parascaris equorum* in Benhur horses may be associated with management practices, deworming frequency, and environmental conditions specific to Bima, underscoring the need for targeted parasite control strategies (Zelpina et al 2022; Phetkarl et al 2024; Hamad et al 2024; Mathewos et al 2021)

Table 1 shows that Benhur horse owners in Bima City are generally of productive age (mean 33.8 years) with low educational levels (5.9% never attended school, 66.7% completed primary school). Their average income (IDR 40,000) is insufficient for daily needs, and most are married with horses as their main income source. Horses used for transport range from 2 to 10 years old. Male horses are predominantly used as draft animals (94.1%) due to their perceived strength and speed. Feeding practices consist mainly of fresh forage (100%), usually unwilted (94.1%), and drinking water from the municipal supply (100%). Most owners have never administered anthelmintics (86.3%).

a b c

Figure 1. Microscopic images of *Parascaris equorum* eggs (a and b) and *Strongyle* spp. eggs (c) detected in the feces of Benhur draft horses in Bima City, West Nusa Tenggara, Indonesia

In Bima, most *benhur* carriage drivers rely on this occupation as their primary source of income (76.5%), and this condition is associated with a 1.83 times higher infection rate among those who depend on it as their main livelihood. In contrast, a study conducted on Lombok Island showed the opposite result, where drivers who consider this job as a secondary source of income actually have a 3.1 times higher risk of infection with *Parascaris equorum* in working horses (Rosyidi et al 2025). Helminth infections are influenced by various factors. In animals, additional factors such as management practices, grazing systems, season, and climate significantly affect the prevalence and transmission of helminth parasites (Charlier et al 2020). Di daerah Bogor, faktor seperti sanitasi kuda dan higiene kandang/pakan berperan dalam infeksi Strongyle (Shatyaayyupranathasari et al 2021). Pada kuda andong di Yogyakarta, pengetahuan dan praktik pemilik/kusir terkait kesehatan kuda juga memengaruhi infestasi nematoda, meski tanpa membedakan pekerjaan primer atau sekunder (Pranaja et al 2024).

Table 2. Odds Ratio (OR) analysis of factors associated with *Parascaris equorum* infestation in Benhur horses in Bima Cit

No	Variabel	Kategori	OR (Odd Ratio)
1	Sources of income	Primary Secondary	1,83
2	Horse sex	Stallion Mare	0,72
3	Type of forage	Grass	-
4	Water source for horses	Well water Municipal water	-
5	Forage feeding method	Segar Dilayukan	2,5
6	Administration of anthelmintics	Never Ever	2,1

In this study, the sex of the horses had a slight influence on cases of *Parascaris equorum* infection in Benhur horses, with an odds ratio (OR) of 0.72, which was higher in male horses. These results differ from several other studies reporting higher prevalence in female horses, such as 100% infection in females compared to 74.1% in males (Apriliawati et al 2019), females being more frequently infected with *Strongylus* spp. (Romero et al 2020), and a significantly higher prevalence in females (82.08%) than males (72.51%) (Lema et al 2024). Other research found that sex was significantly associated with gastrointestinal parasite prevalence but did not specify the direction of the association (Phetkarl et al 2024), whereas another study reported no significant effect of sex on gastrointestinal nematode prevalence (Mathewos et al 2022).

In this study, feeding fresh forage increased the incidence of *Parascaris* infection by 2.5 times compared to feeding wilted forage.It is suspected that wilting forage can reduce the risk of worm infection because L3 larvae require high moisture to move and infect, so drier forage can lower exposure (Opsal et al 2021). This idea aligns with evidence that modifying pasture conditions can reduce parasite contact, as shown in mixed grazing systems that reduce faecal egg counts by about 50% (Forteau et al 2019), lower worm burdens in horses kept in stables compared with those on pasture (Capewell et al 2023), and feedlot cattle that show only about 35% of the egg burden found in grazing cattle (Mpofu et al., 2025). Pasture management that decreases moisture and limits larval survival also reduces risk (Opsal et al 2021), and the high prevalence of helminths in extensively grazed cattle further supports that fresh moist forage is a major source of larval exposure (Haymanot & Kaba, 2022).

The administration of anthelmintics has been shown to reduce the incidence of parascaris infection. Horses that do not receive anthelmintic treatment exhibit a 2.1-fold higher risk of parascaris infection than those that are treated. Anthelmintic use is generally more effective than no treatment, particularly in controlling gastrointestinal nematodes and decreasing the likelihood of clinical disease. In the United States, macrocyclic lactones such as ivermectin and moxidectin have retained high efficacy, whereas benzimidazoles and pyrantel have shown evidence of resistance (Nielsen et al 2018). Australian studies similarly indicate that only moxidectin remains consistently effective, and that routine administration without fecal egg count (FEC) monitoring is inefficient and may accelerate resistance development (McBean et al 2022).

In Ethiopia, although the efficacy of albendazole and ivermectin has declined in some areas due to management practices and treatment frequency, treated horses still perform better than untreated ones, as gastrointestinal nematode prevalence remains high (>65%) in the absence of intervention (Tadesse et al 2025). Furthermore, the risk of parascaris infection increases 2.1-fold in horses that do not receive anthelmintic treatment (Rosyidi et al 2025). Anthelmintic resistance in ruminants across Africa has become widespread, with more than 60% of populations exhibiting resistance to multiple drug classes, underscoring the need for integrated control strategies such as enhanced biosecurity, strategic drug rotation, and FEC-based monitoring (Chikoto et al 2025; Gilleard et al 2025).

4. Conclusions

Gastrointestinal helminth infection in Benhur horses in Bima City was highly prevalent (86.3%), dominated by *Parascaris equorum* (82.4%) and followed by *Strongyle* spp. (3.9%). Parascariasis was most strongly associated with the provision of fresh, unwilted feed, followed by the lack of anthelmintic treatment, the horse owners' occupation, and sex. These findings highlight the need for improved feeding practices and regular anthelmintic administration to reduce infection risk.

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